

Redescriptions of Two Thalestrid Copepods, *Phyllothalestris sarsi* Sewell, 1940 and *Dactylopusia falcifera* Willey, 1935 (Copepoda, Harpacticoida, Thalestridae) in Korea

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ABSTRACT

Two marine harpacticoid species, *Phyllothalestris sarsi* Sewell, 1940 and *Dactylopusia falcifera* Willey, 1935 belonging to family Thalestridae are redescribed from South Korea, on the basis of the specimens of both sexes mainly from the washings of macroalgae at littoral rocky shore or sublittoral bottom sediments during the period from 1994 to 2000. They are new to Korean fauna, and this report is the first record for them in the Pacific Ocean.

Key words: Copepoda, Harpacticoida, Thalestridae, *Phyllothalestris*, *Dactylopusia*, Korea

INTRODUCTION

So far 13 harpacticoid species belonging to the family Thalestridae have been reported from South Korea: *Amenophia orientalis* and *Parathalestris infestus* by Ho and Hong (1988); *Eudactylopus andrewi* and *E. spectabilis* by Chang and Song (1995); *Dactylopusia pauciarticulata* and *Paradactylopusia koreana* by Chang and Song (1997a); *Parathalestris infestus*, *P. parviseta*, *P. bulbiseta*, *P. verrucosa*, *P. pacificus* and *P. areolata* by Chang and Song (1997b); *Pseudonsiella longicaudata* and *Xylora longiantennulata* by Kim and Kim (1997). They are usually epiphytic and most abundant among littoral or sublittoral macroalgae, except *P.*

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longcaudata and *X. longiantennulata* of the subfamily Donsiellinae which were found in the wood holes infested by limnorian isopods.

During the re-examination of our harpacticoid collection, gathered mainly from the washings of macroalgae at littoral rocky shore during the period from 1994 to 2000, we confirmed two more thalestrid species, *Phyllothalestris sarsi* Sewell and *Dactylopusia falcifera* Willey. They are new to Korean fauna, and also known from the Pacific Ocean for the first time. As the original descriptions of them were insufficiently or rather inadequately prepared, we present a redescription of them, with the discussion to their taxonomic features and the affinities, based upon our Korean specimens.

MATERIALS AND METHODS

Materials were obtained mostly from the washings of the various macroalgae inhabiting littoral or sublittoral rocky shores or sublittoral bottom sediments in the various sites of the Korean coastal lines and islands. Some collections were also made using a light trap. Specimens were filtered in the field through nylon net (110 μ m in pore diameter), to be fixed with 5% buffered formalin.

Specimens were dissected and mounted in lactophenol or lactic acid on H-S slide (Shirayama *et al.*, 1993), and examined under an Olympus BX-50 differential interference contrast microscope with Nomarski optics. All drawings and measurements were made with the aid of a camera lucida.

Morphological terminology largely follows Chang and Song (1997a), our previous paper dealing with two new thalestids. Abbreviations are used in the description: P1-P6 indicate the first to sixth pereopods; enp 1-3 or exp 1-3 refer to the first to third endopodal or exopodal segment of each leg; seg. to the segment.

DESCRIPTION

Family Thalestridae Sars, 1905

Subfamily Thalestrinae Lang, 1936

Genus *Phyllothalestris* Sars, 1905

***Phyllothalestris sarsi* Sewell, 1940 (Figs. 1-4)**

Phyllothalestris sarsi Sewell, 1940, p. 180, figs. 21-23; Nicholls, 1941, p. 411; Wells and Rao, 1987, p. 40.

Phyllothalestris lata Nicholls, 1942, p. 135, fig. 2.

Material examined. 1 ♀ (ovi.), Jungmun, Jeju (=Cheju) Is., 24 Jan. 1995, S. J. Song; 1 ♀, 3 ♂ ♂, Tonggumi, Ulleungdo Is., 17 Aug. 1995, S. J. Song; 2 ♀ ♀ (ovi.), Sangju-ri, Namhae, 1 Jul. 1998, S. J. Song; 1 ♀ (ovi.), Hagosu-dong, Udo Isle, Jeju Is., 2 May 2000, S. H. Kim; 2 ♀ ♀, 2 ♂ ♂, Biando Is., Gunsan, 17 Aug. 2000, S. J. Song.

Female. Body about 1.10 mm long, excluding rostrum and caudal rami; whole dorsal surface covered with scales or folds. Rostrum (Fig. 2A) protruding, somewhat narrower anteriorly, with its tip a little directed downward; 1.24 times as long as basal width; defined at its base; a pair of

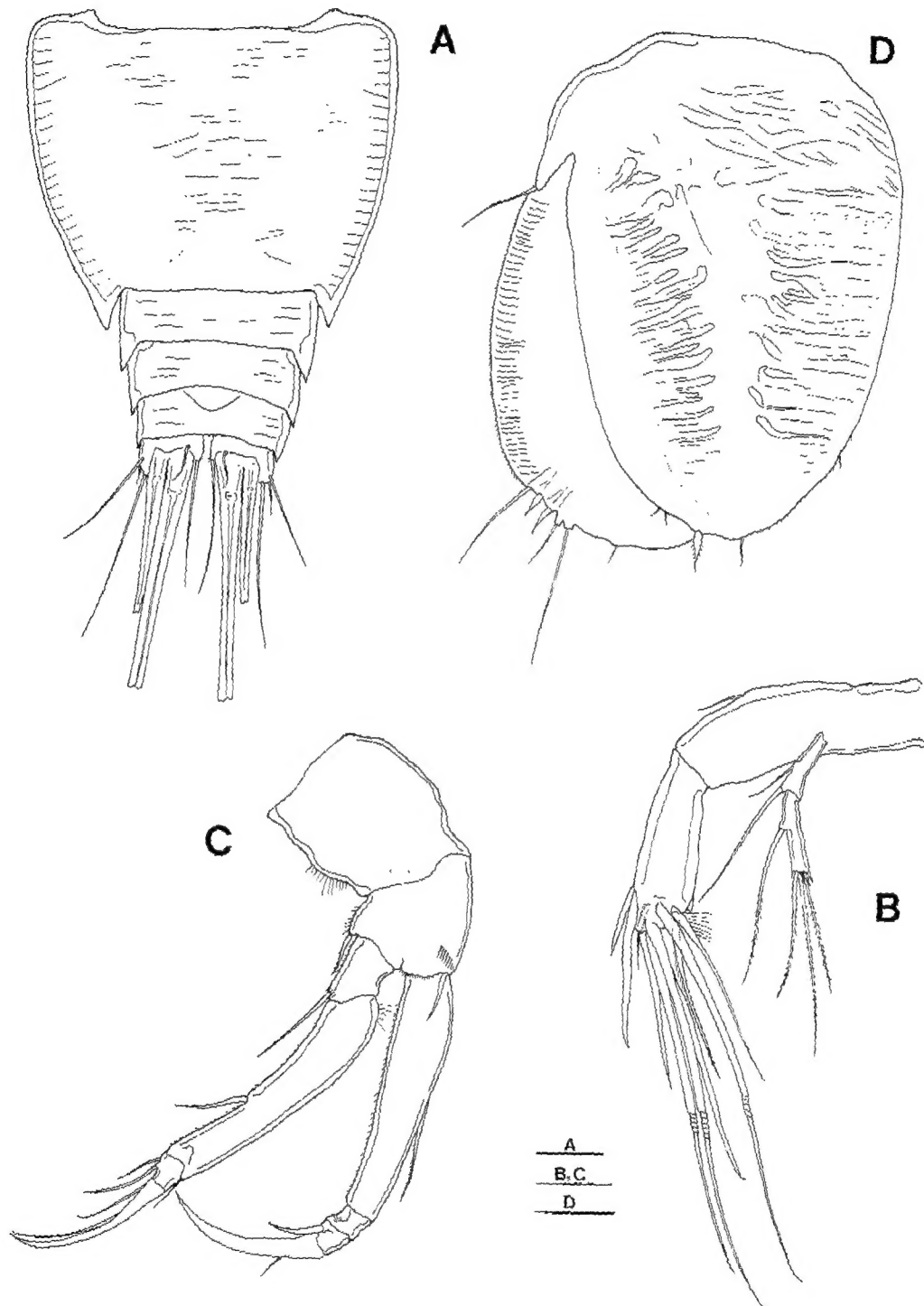


Fig. 1. *Phyllothalestris sarsi* Sewell, female. A, urosome, dorsal; B, antenna; C, leg 1; D, leg 5. Scales = 0.05 mm.

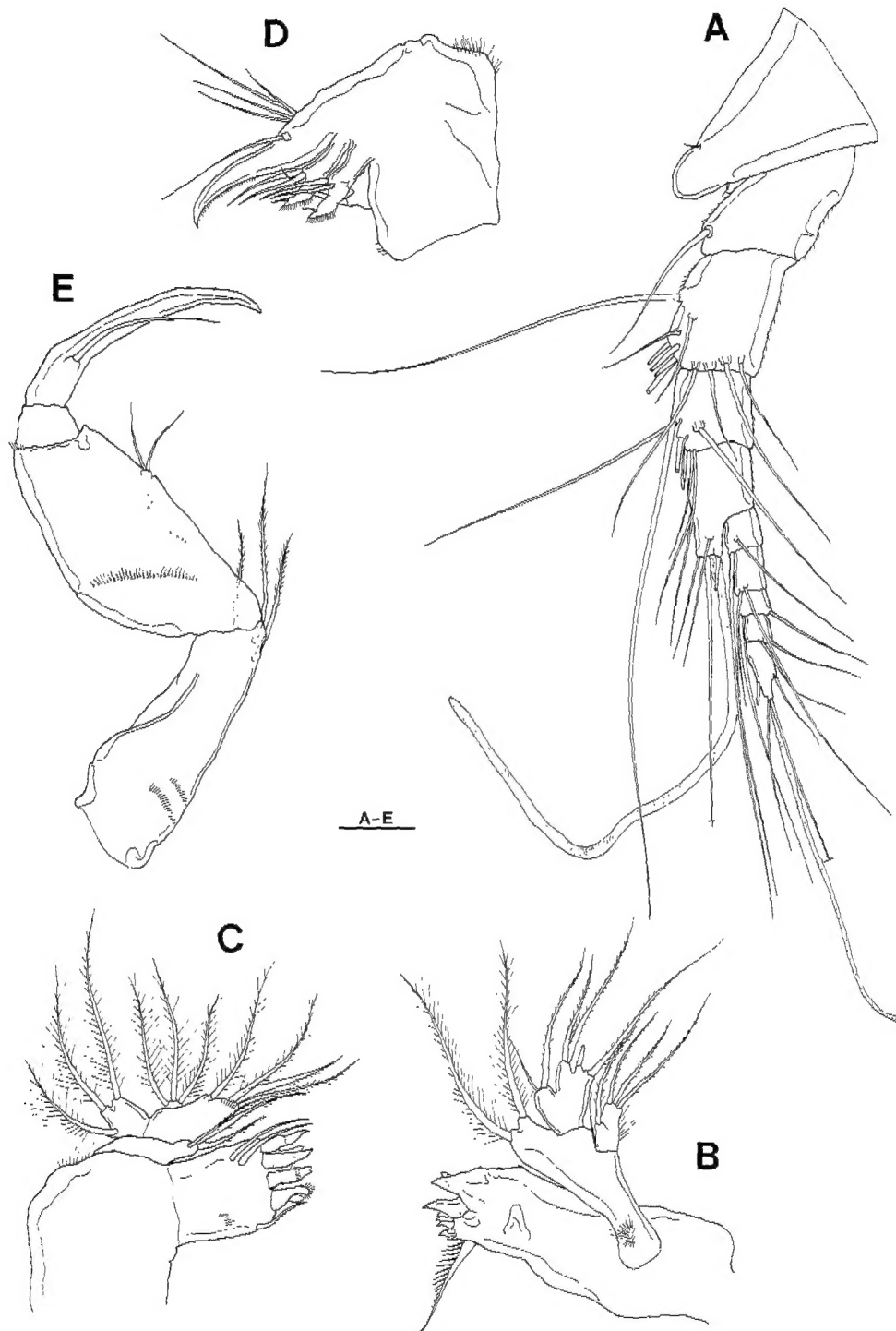


Fig. 2. *Phyllothalestris sarsi* Sewell, female. A, rostrum and antennule; B, mandible; C, maxillula; D, maxilla; E, maxilliped. Scales = 0.03 mm.

sensillae located near apex. Cephalothorax about 1.31 times wider than long, with slender hairs scattered on dorsal or lateral surface. Genital double somite (Fig. 1A) completely fused, forming a large plate, gradually narrowing posteriorly, about 1.25 times broader than long. Caudal ramus (Fig. 1A) slightly parallel, much wider than long; furnished with 2 lateral setae, 2 normal bipinnate distal setae, 1 long bare seta on inner or outer distal edge, and 1 small dorsal seta.

Antennule (Fig. 2A) 9-segmented; first segment longest, with 1 long seta near anterodistal edge and spicule rows on anterior and posterior margins; fourth segment with cylindrical pedestal extending to distal margin of fifth one, with 1 well-developed aesthetasc, about 0.9 times as long as whole antennule.

Antenna (Fig. 1B) with allobasis about 2.9 times as long as maximum width; abexopodal seta minute. Exopod distinctly 2-segmented; proximal segment slightly shorter than distal one, with 1 slender bare seta on midst of outer margin and 1 pinnate seta near distal edge; distal segment bearing 1 lateral and 3 apical pinnate setae. Endopod truncate, and spinules along inner margin; lateral armature consisting of 2 spines; distal armature comprising 1 bipinnate seta, 2 slender setae, 2 spines and 3 geniculate setae.

Coxa of mandible (Fig. 2B) elongate; gnathobase with 3 strong teeth, several multicuspidate blades and 1 pinnate seta at dorsal margin. Basis with spicule rows proximally and 2 plumose setae disteromedially. Endopod trilobed, with 6 pinnate setae in all. Exopod smaller than endopod and ornamented with long hairs along lateral margin, with 1 tiny bare seta basally, 1 pinnate seta on medial knob-like protrusion, and 3 pinnate apical setae.

Praecoxal arthrite of maxillula (Fig. 2C) narrowing distally, ending with 8 setae/spines around distal margin, 2 setae on anteroventral surface, and spicule row posteriorly. Coxal endite with 3 setae. Basis with 1 subapical seta and 2 apical setae. Endopod represented by small protuberance with 3 setae. Exopod bearing 1 seta laterally and 2 distal setae separated each other.

Syncoxa of maxilla (Fig. 2D) with 3 endites: proximal one bilobed, with 2 setae; middle and distal one each forming sharp process, bearing spicule row along inner margin, 1 tiny subdistal hair and 2 setae on dorsal margin. Allobasis bearing strong pectinate claw, with 2 setae. Endopod represented by 1 rudiment carrying 4 long setae.

Maxilliped (Fig. 2E) prehensile; syncoxa with 2 spicule rows on surface and 3 pinnate setae. Basis with spicule row on palmar margin and 2 setae on small knob-like protuberance. Endopod represented by strong, curved claw; accessory armature consisting of 1 long bare seta and 1 short seta.

P1 (Fig. 1C), coxa slightly longer than wide, with many spinules along outer margin and spicule row near posterior margin. Basis somewhat wider than long, with spinules along outer margin, and 1 pinnate outer seta and 1 inner seta. Exopod distinctly 3-segmented; first segment with 1 spine on laterodistal edge and many spinules along lateral margin; second one extremely elongate, with 1 seta at proximal three fifths of outer margin, and with 1 slender seta on disteromedial edge; distal one with 4 bare setae and 1 strong claw. Endopod prehensile, relatively slender and slightly shorter than exopod; first segment elongate, nearly as long as second exopodal segment, with setules along outer margin and 1 pinnate inner seta in the middle of medial edge; second one bearing setule row near laterodistal corner; distal segment armed with 2 claws and 1 bare seta, of which apical claw stout, about 2.8 times longer than outer claw.

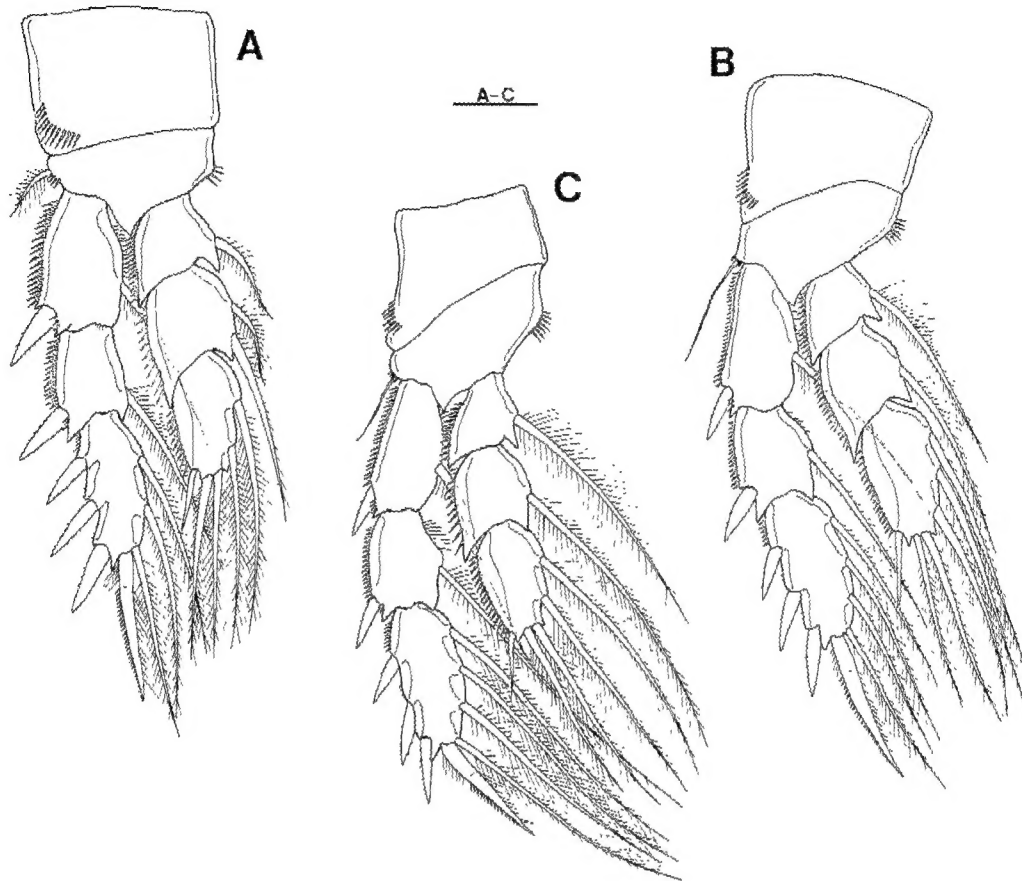


Fig. 3. *Phyllothalestris sarsi* Sewell, A-C, female legs 2-4. Scale = 0.05 mm.

P2-P4 (Fig. 3A-C) with 3-segmented exopods and endopods, basis with outer plumose seta (P2) and bare seta (P3-P4). General shapes of P2-P4 not showing any significant differences from those in original description (cf. Sewell, 1940, figs. 21D, 23C-E). Ornamentation of P2-P4 as follows:

	Exo	End
P2	1, 1, 2-2-3	1, 2, 2-2-1
P3	1, 1, 3-2-3	1, 1, 3-2-1
P4	1, 1, 3-2-3	1, 1, 2-2-1

P5 (Fig. 1D) well-developed and foliaceous. Distal end of baseoendopod reaching end of exopod whole surface of baseoendopod ornamented with numerous folds or scales, bearing 4 short bar setae and 1 laterally swollen pinnate seta. Exopod bearing 2 thick pinnate setae and 3 bare setae subapically with 1 minute seta distally.

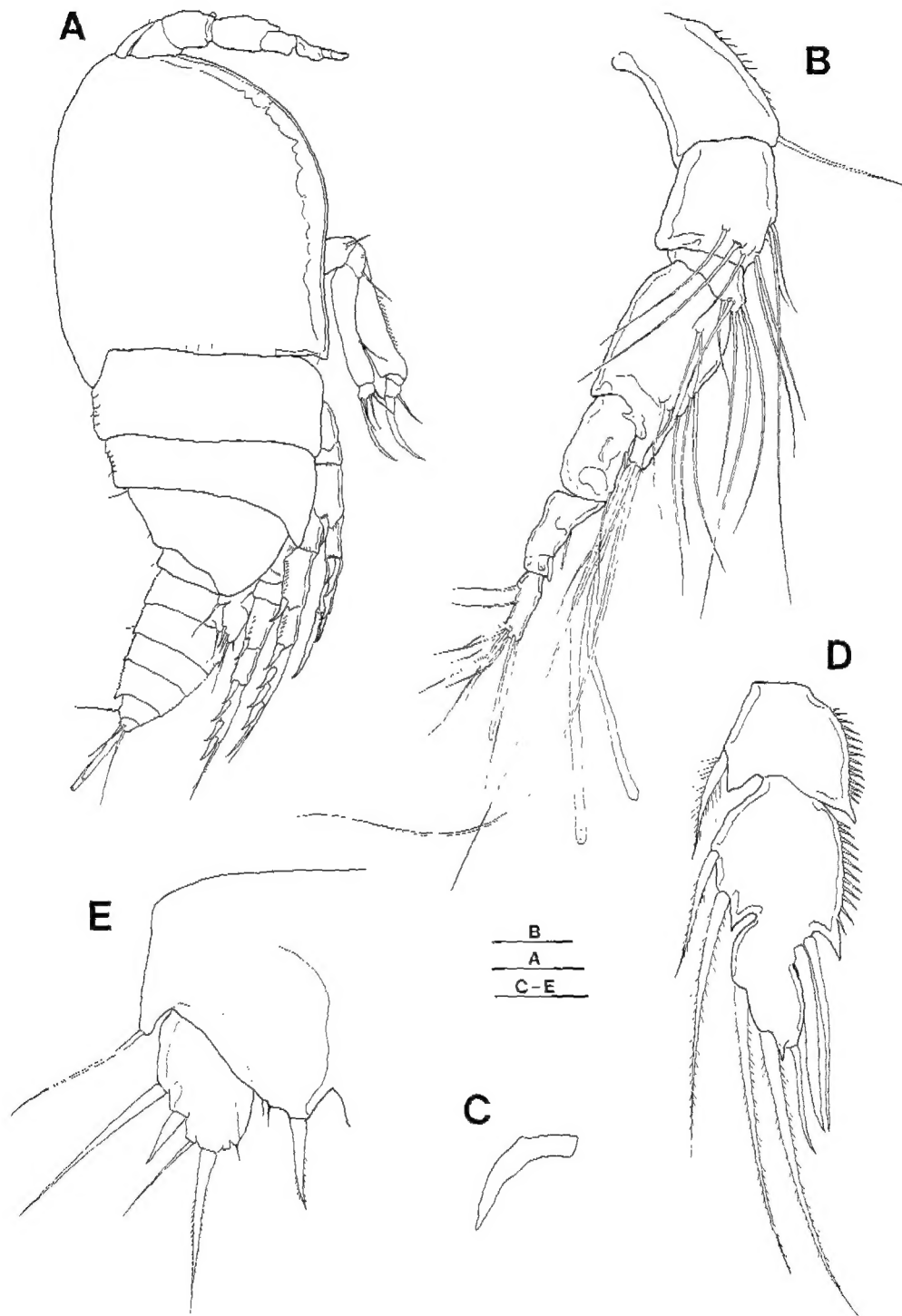


Fig. 4. *Phyllothalestris sarsi* Sewell, male. A, habitus, lateral; B, antennule; C, inner basal spine of the leg 1; D, leg 2 endopod; E, leg 5. Scales: A = 0.1 mm; B-E = 0.03 mm.

Male. Body (Fig. 4A) about 0.76 mm long, excluding rostrum and caudal setae; general body appearance similar to that of female. Antennule (Fig. 4B) 8-segmented, aesthetascs on fourth, fifth, and distal segments. P1 largely similar to female's, except for inner basal spine modified as sickle-shaped process (Fig. 4C). P2 enp (Fig. 4D) modified, distinctly 2-segmented; proximal segment 1 with 1 inner plumose seta; distal segment with 2 modified outer spines, 1 subapical spine, and 2 pairs of plumose inner setae each subdistally and proximally on separated lobes. P3 and P4 endopods not modified, and nearly same in shape with female's. Distal end of baseoendopod not reaching tip of P5 exp (Fig. 4E). Baseoendopod confluent at distal sixth of medial edge, with 1 stout spiniform seta and 2 vestigial tiny setae. Exopod bearing 5 setae/spine: 1 medial vestigial seta, 1 apical pinnate seta, 1 slender subapical seta, and 2 lateral setae/spine. Plates of P6 asymmetric, bearing 2 long and 1 small setae.

Remarks. The genus *Phyllothalestris* Sars consists of only three valid species: *P. mysis* (Claus, 1863), *P. harringtoni* (Willey, 1935), and *P. sarsi* (Sewell, 1940).

P. mysis is seemingly a cosmopolitan species. *P. harringtoni*, which was designated as a distinct species from a 'form' of *P. mysis* by Sewell (1940), is restricted in North Atlantic Ocean, Bermuda and Bahama. *P. sarsi*, the present species is currently known from the Andaman Sea and North or West Australasian Sea. Nicholls (1942) described *P. lata* from Rottneest Island off Western Australia by focussing the width to length ratio of genital segment as a species-discriminating character, however, it was later regarded as a junior synonym of *P. sarsi* by Geddes (1969). Furthermore, Nicholls stated that the *Phyllothalestris* species reported from Sellick Reef of South Australia in the name of *P. mysis* was the same species with *P. lata*. However, it was also synonymized with *P. sarsi* by Geddes (1969).

Our specimens show some discrepancies from Sewell's original description as follows. (1) Our samples have 2-4 setae on antennary exopod, instead of 1-3. Sewell (1940) mentioned that the antenna resembled that of *P. orientalis* (= *P. mysis*), however, Nicholls (1942) stated that *P. lata* (= *P. sarsi*) were different from *P. mysis* in having only one seta on the proximal segment. Later Wells and Rao (1987) re-examined the South Australian material of Nicholls (1941) and confirmed that it had two setae on the proximal segment. (2) Female baseoendopod bears an apical pinnate seta, while it was figured as a simple bare seta in Sewell's. (3) In the ornamentation of female P5 exopod, second outer spine is relatively larger than Sewell's, and second inner seta is not plumose but bare. (4) Judging from Sewell's illustration, male antennule consists of 11 segments, while 8 segments in ours. (5) Proximal and subapical inner seta on male P2 enp 2 is plumosed in ours, against rather modified spiniform seta in Sewell's. (6) In male leg 5, an inner seta of exopod are represented by a small vestigial seta, instead of a well-developed pinnate seta as in Sewell's.

Furthermore, Korean specimens show the additional differences from Nicholls (1942)'s which lacks inner seta on female P5 baseoendopod and has a long second outer seta on it against the vestigial ones in ours.

As listed above, several discrepancies between Korean specimens and the populations from the Indian Sea seem even considerable. However, we admit that the fairly big variation range within the species have been known in this genus, and so we came to the conclusion that Korean specimens are within the variation range.

This species has been known from the Indian coast of the Andaman Sea and from the sea

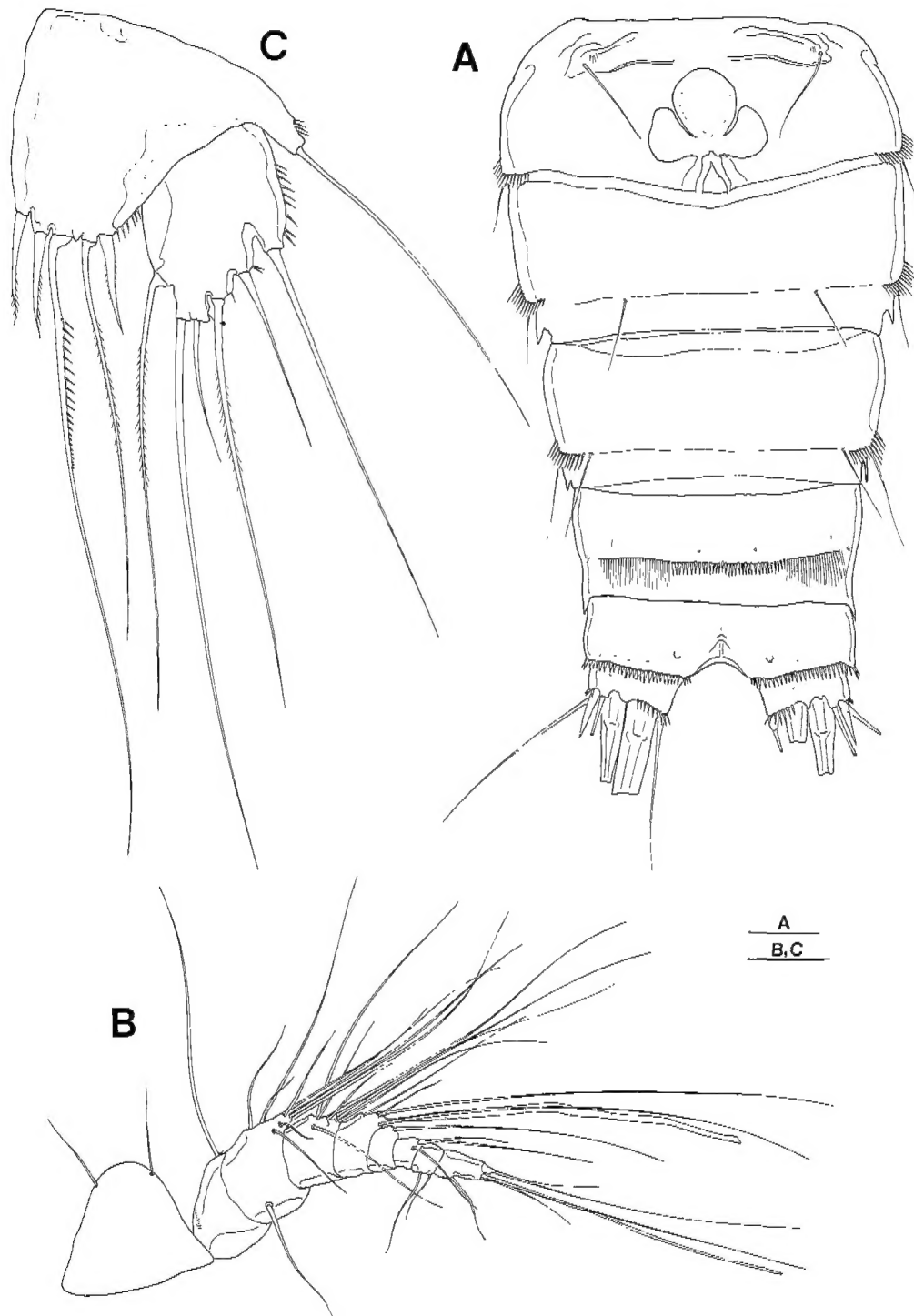


Fig. 5. *Dactylopusia falcifera* Willey, female. A, urosome, ventral; B, rostrum and antennule; C, leg 5. Scales = 0.03 mm.

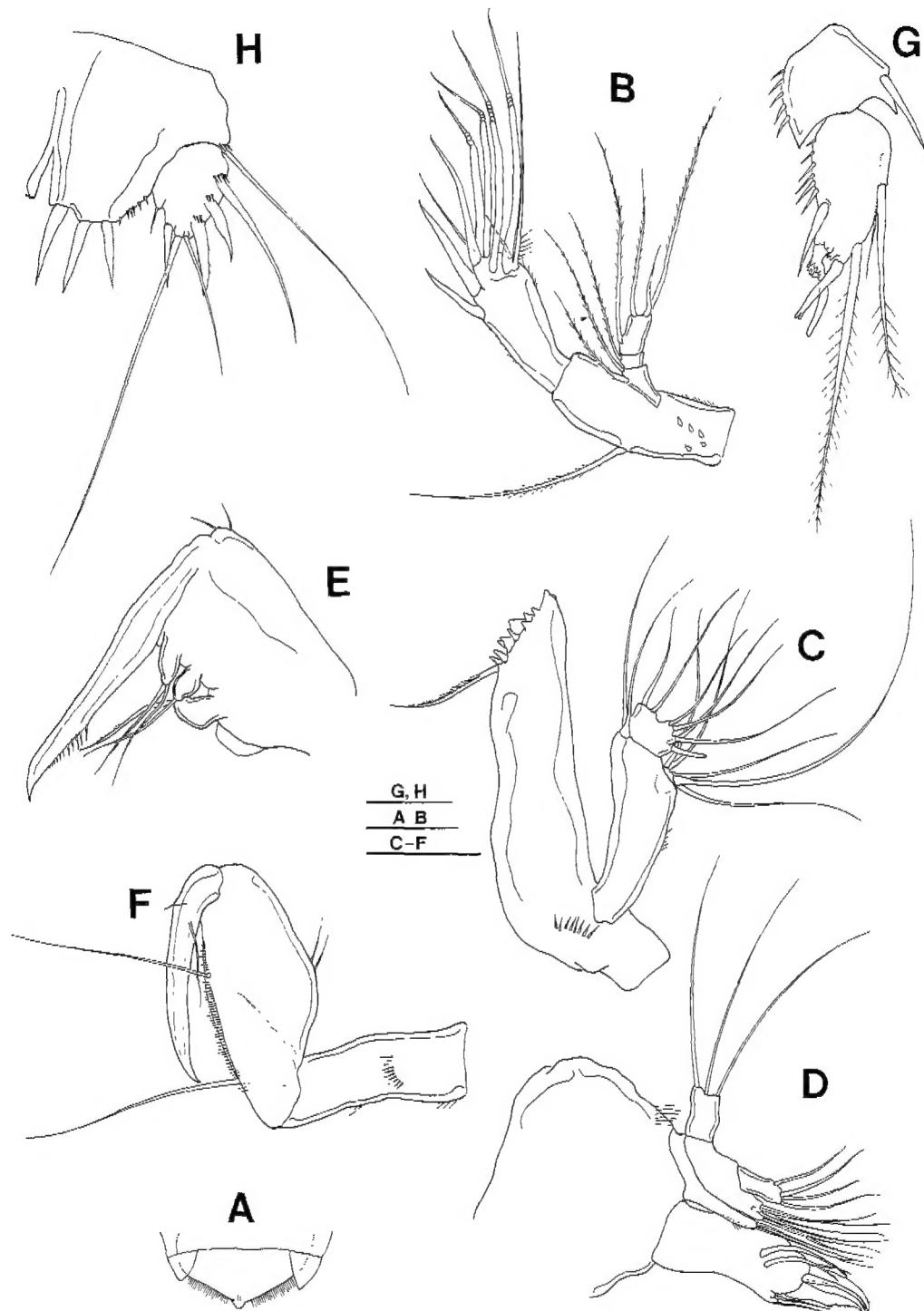


Fig. 6. *Dactylopusia falcifera* Willey, A, operculum; B, antenna; C, mandible; D, maxillula; E, maxilla; F maxilliped; G, female leg 2 endopod; H, male leg 5. Scales = 0.03 mm.

around south and west Australia until now, so this is the first record for *P. sarsi* from the Pacific Ocean.

Distribution. Bay of Bengal (Andaman Is., Nicobar Is.), Gulf of Manaar, South and West Australia, Korea (East Sea, South Sea, Yellow Sea, Jeju Is.).

Subfamily Dactylopusiinae Lang, 1936

Genus *Dactylopusia* Norman, 1903

***Dactylopusia falcifera* Willey, 1935 (Figs. 5-7)**

Dactylopusia falcifera Willey, 1935, p. 73, figs. 92-97.

Dactylopusia falcifera f. *violacea* Sewell, 1940, p. 223, figs. 41A-N.

Dactylopusia falcifera f. *pallida* Sewell, 1940, p. 226, figs. 42A-C.

Dactylopusia falcifera: Lang, 1965, p. 192.

Material examined. 1 ♂, Songjeong, Pusan, 26 Jan. 1994, J. M. Lee; 1 ♂, Songjeong, Pusan, 20 May 1994, J. M. Lee; 5 ♀♀ (1 ovi.), 8 ♂♂, Namjeong-ri, Yeongdeok, 10 Nov. 1995, S. J. Song; 1 ♀, 3 ♂♂, Masan-ri, Pohang, 24 Oct. 1996, S. J. Song; 1 ♂, Masan-ri, Pohang, 21 Dec. 1996, S. J. Song; 1 ♂, Kuryongpo, 24 Oct. 1996, S. J. Song; 1 ♂, Kuryongpo, 21 Dec. 1996, S. J. Song.

Female. Body length about 0.64 mm, excluding rostrum and caudal rami. Cephalothorax about 1.34 times wider than long, with hairs (sensillae) scattered on dorsal surface. Rostrum large (Fig. 5B) slightly directed downward, defined at its base, about 1.2 times wider than long, broadly rounded at tip and paired sensillae located near apex. Genital double somite (Fig. 5A) slightly broader than long; gradually narrowing posteriorly; plane of fusion indicated by faint chitinous suture ventrally. Penultimate abdominal somite (Fig. 5A) ornamented with 1 transverse row of short and long setules on ventral surface as figured. Anal somite with smooth semi-circular operculum (Fig. 6A), armed with numerous spinules ventrally on posterior margin.

Caudal rami (Fig. 5A) slightly divergent, much wider than long; armed with 7 caudal setae, including 1 dorsal seta triarticulated at its base.

Antennule (Fig. 5B) 8-segmented; first segment with 1 long naked seta on anterodistal corner, and 1 spicule row on anterior proximal surface; second one longest; cylindrical pedestal of fourth one protruded, reaching middle of succeeding segment, with 1 long aesthetasc at its tip.

Antenna (Fig. 6B) with allobasis about 3 times as long as maximum width; abexopodal seta well-developed. Exopod distinctly 3-segmented; proximal segment with 2 pinnate setae, second one bearing 1 pinnate seta, distal one with 1 proximal, 1 subdistal and 2 distal setae. Endopod elongate, broader distally, with spinules along inner and outer margin; armature consisting of 2 disteromedial spines and 1 pinnate, 3 bare, 1 spine and 4 geniculate terminal setae.

Coxa of mandible (Fig. 6C) elongate and gradually narrowing distally. Gnathobase with several multicuspidate blades and 1 pinnate seta at dorsal margin. Basis with spinules along outer margin and 2 setae on inner distal edge. Endopod bilobed, with 7 setae in total. Exopod smaller than endopod with 5 setae.

Praecoxal arthrite of maxillula (Fig. 6D) narrowing distally, ending with 4 spines and 2 setae around distal margin and 2 setae on anteroventral surface. Coxal endite with 1 subdistal and 2 distal setae. Basis with 1 subapical seta and 5 apical setae. Endopod somewhat shorter than

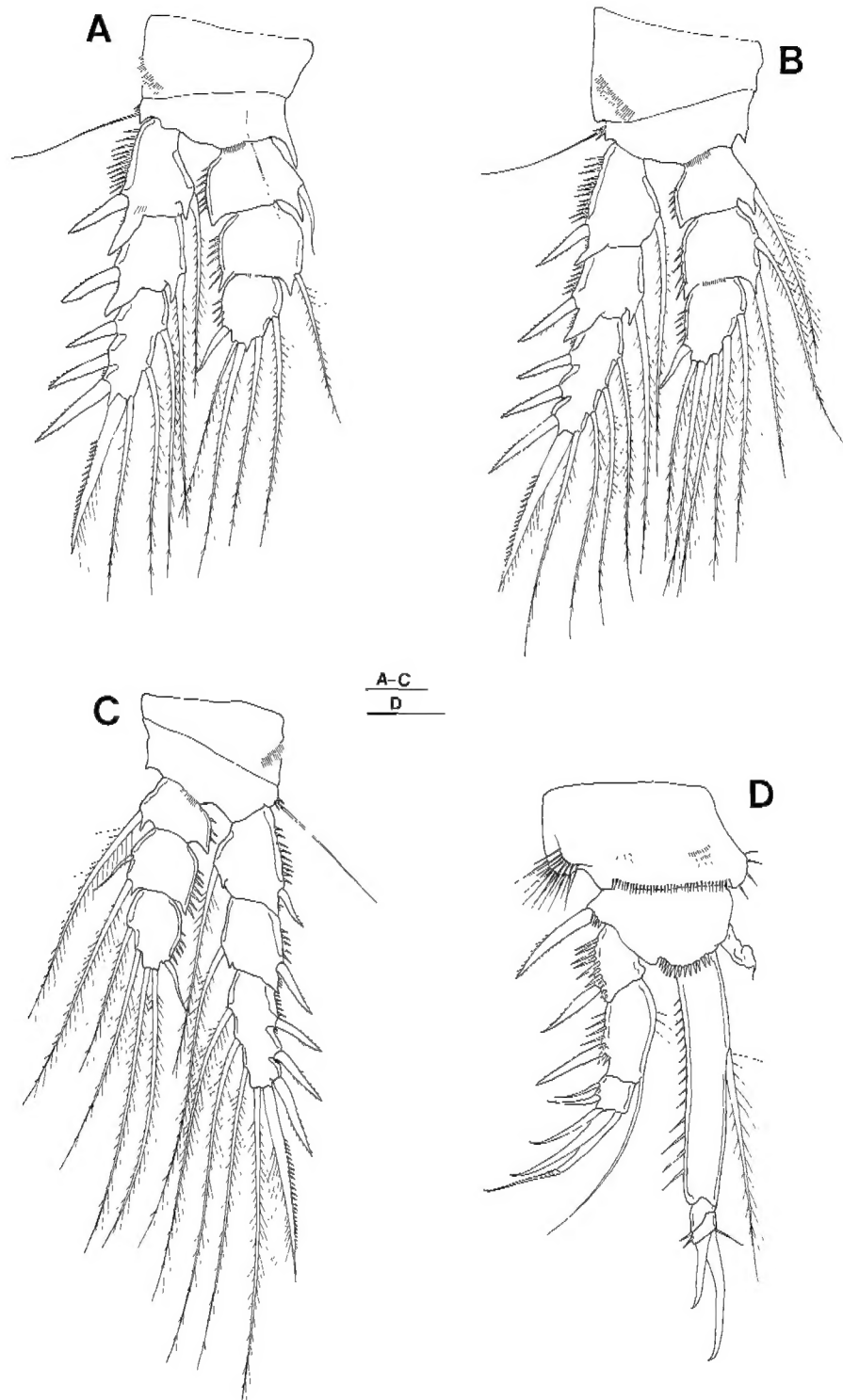


Fig. 7. *Dactylopusia falcifera* Willey, A-C, female legs 2-4; D, male leg 1. Scales: A-D = 0.03 mm

exopod with 4 setae. Exopod bearing 3 long setae.

Syncoxa of maxilla (Fig. 6E) with 3 endites: proximal one largest with 1 pinnate seta, middle and distal one each bearing 1 and 2 bare setae; allobasis bearing strong pectinate claw.

Maxilliped (Fig. 6F) prehensile; syncoxa with 1 spicule row on ventral surface and 2 bare setae distally. Basis with spicule row and 1 long seta on palmar margin. Endopod represented by 1 strong, curved claw; accessory armature consisting of 2 setae.

P1 coxa slightly wider than long with many spicule rows as in Fig. 7D. Basis somewhat wider than long with 1 pinnate outer spine and 1 inner spine. Exopod distinctly 3-segmented, much shorter than enp 1; first segment with a spine on outerodistal edge and many spinules along outer margin; exp 2 longest, with 1 spine on distal third of outer margin and with 1 bare seta on inner distal edge; distal one with 4 spines and 1 apical geniculate seta. First endopodal segment longest with setules along outer margin and 1 plumose seta inserted near middle of inner margin; second one bearing setule row near outer edge; distal one furnished with 2 prehensile claws and 1 slender seta, of which inner claw about 1.7 times longer than outer one.

P2-P4 (Figs. 7A-C) with 3-segmented exopods and endopods. Ornamentation of P2-P4 as follows:

	Exo	End
P2	1, 1, 2-2-3	1, 2, 2-2-1
P3	1, 1, 3-2-3	1, 2, 3-2-1
P4	1, 1, 3-2-3	1, 2, 2-2-1

P5 (Fig. 5C) well-developed, distal end of baseoendopod extending to middle of exopod, ornamented with 3 short and 2 long pinnate setae, of which middle one longest with sharp setules outward; exopod with total 6 setae, comprising 1 inner, 2 distal and 3 outer ones, of which second innermost one longest.

Male. Body about 0.61 mm long, excluding caudal setae. General body shape similar to that of female. All abdominal segments with setule lines ventrally. Antennule 8-segmented, of which third and fifth one short and fourth one long; aesthetascs each on third, fourth and distal one. P1 (Fig. 7D) similar to female's, except the modified inner basal spine, as figured. Endopod of P2 (Fig. 6G) modified, 2-segmented; proximal segment with 1 short inner seta and several spinules along outer margin; distal one bearing 1 outer spine and 2 modified apical spines, 1 long subdistal plumose seta, 1 plumose inner seta, and 1 slender inner proximal seta; outer apical spine bent inward at proximal quarter with lots of denticles; inner apical spine bifid at its tip. P3 and P4 nearly same in shape with female's. Distal end of baseoendopod slightly not reaching tip of P5 exp (Fig. 6H); baseoendopod confluent on distal third of its inner margin, with 3 spines; exopod small and bearing 7 setae/spines, of which innermost one represented by very short seta and third innermost seta longest. P6 represented by 3 setae, of which outermost one very short and middle one longest.

Remarks. Lang (1948) suspected that Willey probably had mixed a *Dactylopusia* species with a *Diathrodes* when he described *D. falcifera* from Bermuda. However, he later reaffirmed it (Lang, 1965: 192), after the investigation of Sewell (1940)'s two 'forms', *D. falcifera* f. *pallida* and *D.*

falcifera f. *violacea*. Sewell differentiated the two forms by the coloration, fourth abdominal segment and the contour of female P5. However, judging from the figures and description he supplied, they are assumed to be the varieties or forms of the same species, not another distinct species nor even subspecies as Bodin (1997) designated them. As the original description of *D. falcifera* Willey, 1935 and the description of two forms were rather poorly prepared, any assertion on their true taxonomic status or on the relations among them should be provisionally reserved until the type specimens as well as the male of *D. falcifera* f. *pallida* will be fully re-examined afterwards.

Examining Korean specimens, some discrepancies between ours and those from Bermuda or Nicobar Islands are noticeable: (1) as for female P5, our specimens are similar to the form *pallida* of Sewell than Willey's, (2) the midst baseoendopodal seta of ours have sharp setules peculiarly, as mentioned above, (3) in male P2 enp, our materials have a more smooth and much curved falcate spine than Willey's (although he did not describe it in detail, it was not dentated but furnished with setules proximally, according to his figure (Sewell, 1940: 74, fig. 97); moreover, distal modified spine is sharply pointed, while ours is not pointed with its tip bifid, (4) our specimens are discernible from the form *violacea* in the shape of modified spines on male P2 enp (only 2 setae present on inner margin, and 2 modified spines shaped like a harpoon and a simple curved spine in the form *violacea*).

Distribution. Bermuda, Nicobar Island, Korea (East Sea, South Sea).

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한국산 요각류, *Phyllothalestris sarsi* Sewell, 1940와
Dactylopusia falcifera Willey, 1935 (요각아강, 갈고리노벌레목,
 Thalestridae과)의 재기재

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요 약

1994년부터 주로 한국의 조간대 해조류 및 아조간대 바닥 퇴적물을 걸러 채집하여 보관중이던 Thalestridae과의 갈고리노벌레류를 재검토한 결과 *Phyllothalestris sarsi* Sewell, 1940과 *Dactylopusia falcifera* Willey, 1935의 2종을 추가로 동정하였다. 이 종들은 태평양에서 처음으로 보고되는 종이다. 2종 모두 원기재가 부족하여 한국산 표본을 재료로 하여 재기재를 하였고, 근연종과의 형질비교 및 변이성 등에 관하여 고찰하였다.